

Mycotoxins concept

Mycotoxins are toxic structurally diverse, secondary metabolites produced by a wide range of moulds and they infect food and feed and agricultural commodities.

Characteristics of mycotoxins;

1. Mycotoxins are complex structures and most of them are phenolic and alkaloids compound.
2. Low molecules weight (less than 10^4 Dalton).
3. Accumulation in tissues.
4. Mycotoxins can not to induce of immunity system, so that is not able to cancel of mycotoxins activity.
5. Most of mycotoxins are heat stable.

Classification of mycotoxins;

The mycotoxins are classified to many groups but the classified bases are different between the mycotoxins classification system and another;

A. Classification depended on target organism affects

1. The mycotoxins effected on liver called Hepatotoxins.
2. The mycotoxins effected on Neuro tract called Neuro toxins.
3. The mycotoxins effected on kidney referred Nephro toxins.

B. Classification depended on chemical nature of mycotoxins

1. The mycotoxins consist of coumarin lactones called polyketides.
2. Mycotoxins derived from amino acid referred amino acid – derived.

C. Classification depended on the diseases caused by mycotoxins;

1. Reyes syndrome mycotoxins.
2. Stachybotry toxosis.

D. Classification is depended on the fungal produce of mycotoxins;

1. Mycotoxins produced by Aspergillus called Aspergillus toxins.
2. Mycotoxins produced by Penicillium referred Penicillium toxin.

Effects of mycotoxins

1. **Biochemical and physiological effects of mycotoxins. The biochemical effects of mycotoxins including;**
 - a. They are inhibition of protein synthesis.
 - b. They are inhibition of RNA and DNA synthesis.
 - c. Some of mycotoxins are able to interact with other enzymes.
 - d. The mycotoxins are able to increase of GOT and GPT levels in blood addition of sugar, other hand some mycotoxins decrease the number of RBCs and Hb level and also the hormones levels are decreased.

2. **Nephrotoxicity** :- the kidney is major site of mycotoxins – induced toxicity where its principle on the middle and terminal segments of the proximal convoluted tubules studies have shown that OTA exposure can lead to increased urine volume, blood urea nitrogen, urinary glucose and protein urea as well as to reduction in the activity of enzymes in the kidney such as alkaline phosphatase, leucine amino peptidase.
3. **Carcinogenicity**:- the carcinogenicity of mycotoxins with the kidney and liver. Aflatoxin B₁ and ochratoxins have been implicated in the development of cancers of the human liver and urinary tract recepectively.
4. **Genotoxicity** :- A few mycotoxins induced DNA damage have been reported. DNA single strand breaks have been observed consistently in mammalian cell culture. DNA strand breaks have also been observed in vivo assay in the spleen, liver, kidney cell of mice intraperitoneal injection of mycotoxins such as OTA and AFB₁.
5. **Immunotoxicity**:- Mycotoxins have been shown to affect a number of parameters of immune function. The numbers of splenocytes are reduction. The animals lab treated with mycotoxins become susceptible to infection with Salmonella Choleraesuis. The mechanism of mycotoxins – induced immunosupression in animals are unclear although studies suggest that it may be related to the inhibitory effect

of mycotoxins on DNA and protein synthesis in lymphocytes, macrophages, and other immune system types.

6. Neurotoxicity

- The potential neurotoxicity of mycotoxins has been investigated in a limited number of animal and invitro studies. In small study lesions in the ventral mesencephalon, hippocampus, striatum and cerebellum of the brain were found after four rats were administered (29µg OTA/Kg) body weight oral gavages for eight days.
- Increase in Δ – glutamyl trans fevase activity in the brain.
- OTA inhibits protein and DNA synthesis.

Toxic effects of mycotoxins in tissues

Mycotoxins caused pathogenic changes in many organs tissues as small intestine represented by shrinkage of intrastructure of it and increase of lymphocytes cell, while in liver sever vascular congestion and necrosis occur and in kidney highly proliferation of cell in endothelial layer of Bowman's capsules in addition to hemorrhage and focal aggregate inflammatory cell.

1. Liver

- Necrosis
- Hemorrhage
- Bile duct proliferation

- Liver fibrosis
- Hepato cellular carcinoma

2. Kidney

- ❖ Cancer
- ❖ Increase urine volume
- ❖ DNA single strand breaks
- ❖ Granulation
- ❖ Hemorrhage

3. Lungs

- a. Pulmonary edema
- b. Pulmonary interstitial fibrosis

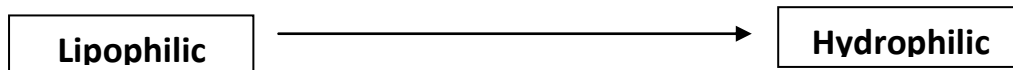
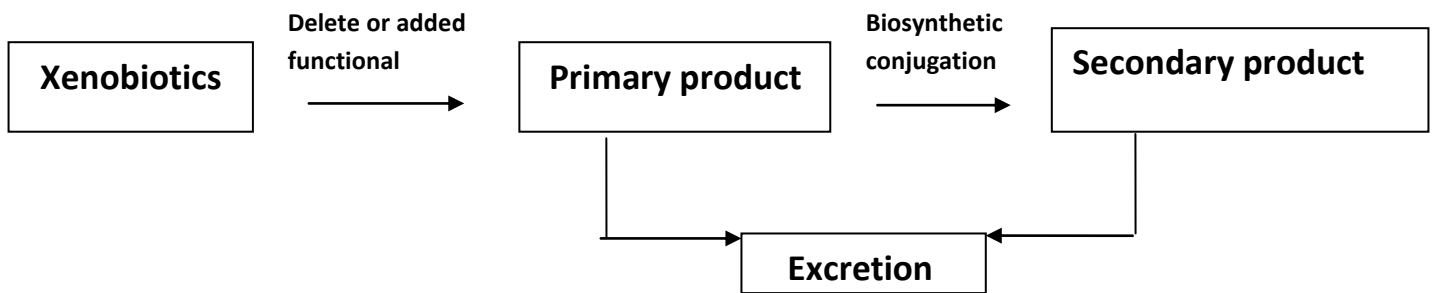
4. Small intestine :- Decay of mucosa

The major fungi producing mycotoxins

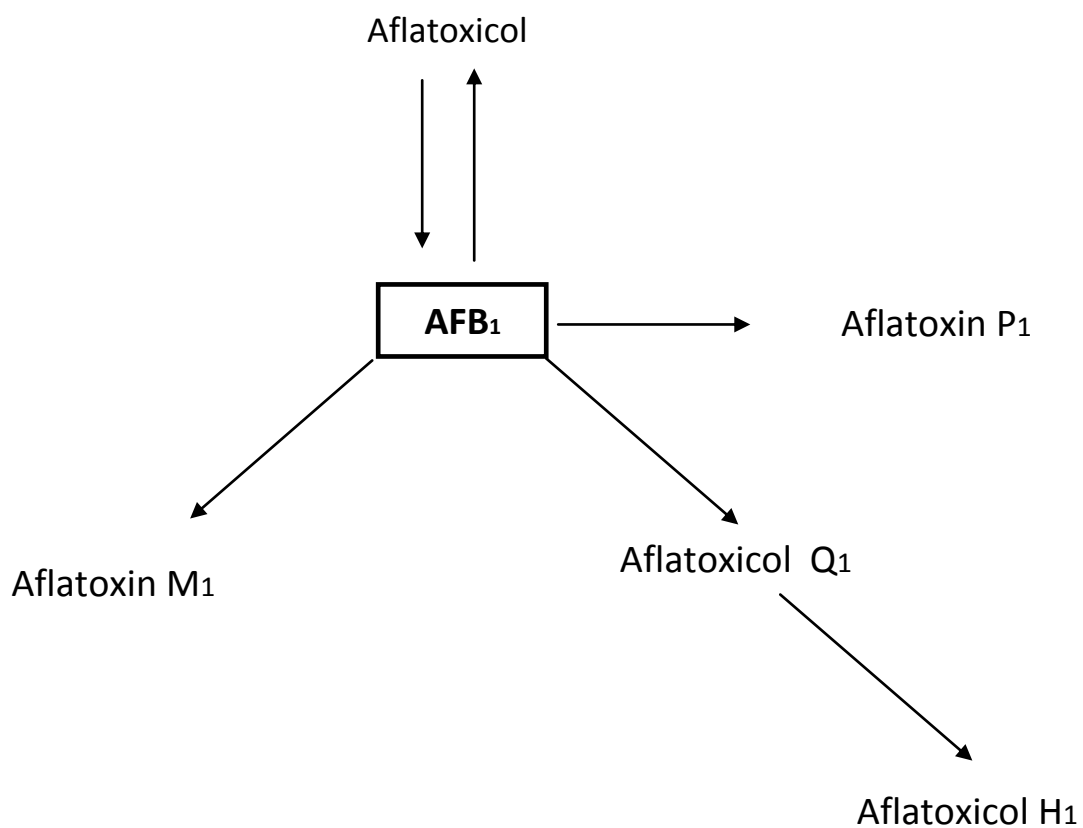
Fungi belonging to the genera Aspergillus, Penicillium, Alternaria, Fusarium and Geotrichum are major contributors to food and feed. These fungi produce mycotoxins that are of concern to human health. The most common mycotoxins associated with food and feed are Aflatoxins, Ochratoxins A, Patulin, Zearalenon, Fumonisin, Trichothecens, Geotrichum toxins and

Metabolism of mycotoxins

Transformation is process including large number of bioreaction and their reaction are occur through two phases as the following :



For example : metabolize of Aflatoxin in Liver .



Factor affecting mycotoxins production in foods

The factor affect in mycotoxins production involves :

1- Water activity : water content of foods or feeds referred water activity while the microorganisms (Bacteria , Fungi , and anther) can be absorption of this water . Most of fungi can be growth and production of mycotoxins about (0.88 – 0.99) .

2- Temperature : the fungi growth and mycotoxins production are in range between (5- 35)C° but the optimal temperatre is (25- 30) C° .

3- PH : the ph substance affective in fungi growth and mycotoxins production . the lytic enzymes activities for organic substance are decrease while the ph increased but the production of mycotoxins increased while the ph decreased .

4- Aeration : the fungi are aerobic organism and the O₂ is major required for growth and reproduction . most of fungi can not growth without O₂ .

5- The types of foods : The foods are rich with protein and poor with carbohydrate are growth stable fungi , but not stable for mycotoxins produce glucose and sorbitol are helping to mycotoxins production while the complex saccharides are inhibition product of mycotoxins .

6- Strain of fungus : The strains of fungi are able to produce mycotoxins , controlling of their ability of produce many genes .